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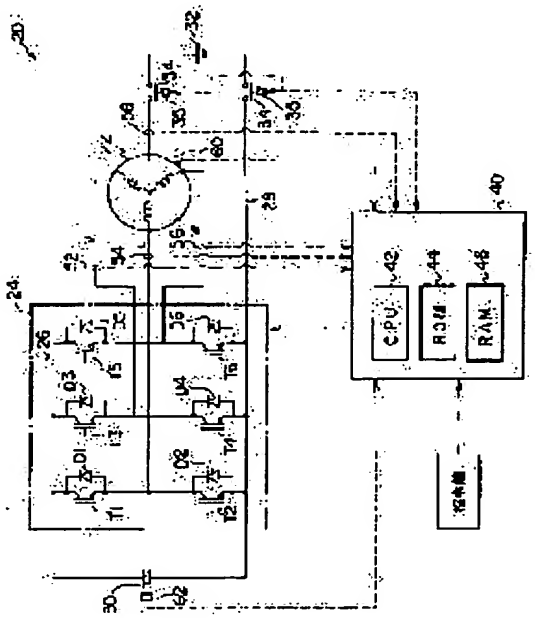
(54) POWER OUTPUT DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To prevent an electric motor from outputting unexpected torque at the start and to start quickly.
SOLUTION: When a DC power supply 32 is connected by switching on a relay 34 at a start, transistors at the negative pole bus 28 of an inverter circuit 24 are switched on to form a short-circuit with regard to the phase of the minimum phase current of each of u, v, w phase currents. As for the other phases, a capacitor 30 is initially charged by repeating the process of forming a charging circuit by switching off the transistors at the negative pole bus 28 of the inverter circuit 24. Because the current increasing speed in the short- circuit is larger than that in the charging circuit, the current-increasing speed of each phase can be equalized by repeating the above process. Consequently, because the equalized current of each phase can be caused to flow, the output of the unexpected torque from a motor 22 can be prevented when the capacitor 30 is initially charged.



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CLAIMS

[Claim(s)]
[Claim 1] Polyphase current power by the power source, the motor which carries out a rotation drive by the polyphase current, and switching actuation of two or more switching elements The inverter circuit which can be supplied to said motor, The connecting means which performs discharge of connection of said power source to the bus-bar of the either the positive-electrode bus-bar of said inverter circuit or the negative-electrode bus-bars and the neutral point of said motor, and connection, The accumulation-of-electricity means which was connected to the positive-electrode bus-bar and negative-electrode bus-bar of said inverter circuit and in which charge and discharge are possible, and when starting directions are made, A power output unit equipped with the starting tense means which connects said power source by said connecting means after starting switching control to two or more switching elements of said inverter circuit at the time of starting.
[Claim 2] Polyphase current power by the power source, the motor which carries out a rotation drive by the polyphase current, and switching actuation of two or more switching elements The inverter circuit which can be supplied to said motor, The connecting means which performs discharge of connection of said power source to the bus-bar of the either the positive-electrode bus-bar of said inverter circuit or the negative-electrode bus-bars and the neutral point of said motor, and connection, The accumulation-of-electricity means which was connected at the bus-bar to which said power source is not connected by said connecting means among the positive-electrode bus-bar of said inverter circuit, and a negative-electrode bus-bar, and the neutral point of said motor and in which charge and discharge are possible, and when starting directions are made, A power output unit equipped with connection of said power source by said connecting means, and a starting tense means to perform switching control at the time of starting to two or more switching elements of said inverter circuit.
[Claim 3] Switching control is a power output unit according to claim 1 or 2 which is the control which switches said two or more switching elements so that torque may not be outputted from said motor at the time of said starting.
[Claim 4] At the time of said starting, there is no claim 1 which is the control which switches said two or more switching elements so that the current which flows to each phase of said motor may become equal, and switching control is the power output unit of a publication 3 either.
[Claim 5] It has each phase current detection means to be a power output unit according to claim 4, and to detect the current of each phase of said motor. Said starting tense means Until this low ****** is canceled to the phase of the condition that a current value is low, among the currents of each phase detected by said each phase current detection means The power output unit which is a means to perform control which switches said two or more switching elements so that said motor and said power source may form a short circuit as switching control at the time of said starting.
[Claim 6] Polyphase current power by the power source, the motor which carries out a rotation drive by the polyphase current, and switching actuation of two or more switching elements The inverter circuit which can be supplied to said motor, The connecting means which performs discharge of connection of said power source to the bus-bar of the either the positive-electrode bus-bar of said inverter circuit or the negative-electrode bus-bars and the neutral point of said motor, and connection, The accumulation-of-electricity means which was connected to the positive-electrode bus-bar and negative-electrode bus-bar of said inverter circuit and in which charge and discharge are possible, an accumulation-of-electricity condition detection means to detect the accumulation-of-electricity condition of this accumulation-of-electricity means, and when a stop order is made, A power output unit equipped with a halt tense means to perform discharge of connection of said power source by said connecting means, and predetermined switching control to two or

more switching elements of said inverter circuit based on the accumulation-of-electricity condition of said accumulation-of-electricity means detected by said accumulation-of-electricity condition detection means.
[Claim 7] Polyphase current power by the power source, the motor which carries out a rotation drive by the polyphase current, and switching actuation of two or more switching elements The inverter circuit which can be supplied to said motor, The connecting means which performs discharge of connection of said power source to the bus-bar of the either the positive-electrode bus-bar of said inverter circuit or the negative-electrode bus-bars and the neutral point of said motor, and connection, The accumulation-of-electricity means which was connected at the bus-bar to which said power source is not connected by said connecting means among the positive-electrode bus-bar of said inverter circuit, and a negative-electrode bus-bar, and the neutral point of said motor and in which charge and discharge are possible, and when a stop order is made, A power output unit equipped with a halt tense means to perform discharge of connection of said power source by said connecting means, and predetermined switching control to two or more switching elements of said inverter circuit based on the accumulation-of-electricity condition of said accumulation-of-electricity means detected by said accumulation-of-electricity condition detection means.
[Claim 8] Said halt tense means While holding connection of said power source by said connecting means in the condition that the accumulation-of-electricity condition of said accumulation-of-electricity means can act an electrical potential difference higher than the electrical potential difference of said power source The 1st switching control is performed at the time of a halt which switches said two or more switching elements so that the charge of said accumulation-of-electricity means may be supplied to said power-source side. While said connecting means cancels connection of said power source in the condition which cannot be acted in an electrical potential difference with the accumulation-of-electricity condition of said accumulation-of-electricity means higher than the electrical potential difference of said power source The power output unit according to claim 6 or 7 which is a means to perform the 2nd switching control at the time of a halt which switches said two or more switching elements so that the current from said accumulation-of-electricity means may flow to each phase of said motor.
[Claim 9] Switching control is a power output unit according to claim 8 which is the control which switches said two or more switching elements so that torque may not be outputted from said motor at the time of switching control and said 2nd halt at the time of said 1st halt.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a power output unit.
[0002]
[Description of the Prior Art] Conventionally, the thing equipped with the DC power supply connected at the capacitor, the positive-electrode bus-bar of an inverter circuit or negative-electrode bus-bar connected to the positive-electrode bus-bar and negative-electrode bus-bar of the inverter circuit which impresses the three-phase alternating current to a motor as this kind of a power output unit, and the neutral point of a motor is proposed (for example, JP,10-337047,A, JP,11-178114,A, etc.). With this equipment, while regarding it as the pressure-up chopper circuit which carries out the pressure up of the electrical potential difference of DC power supply for the circuit which consists of a coil of each phase of a motor, and a switching element of each phase of an inverter, and stores a charge in a capacitor, it considers that this capacitor that it stored electricity is DC power supply, and a motor is driven. The switching operation of the switching element of the inverter circuit at the time of impressing the false three-phase alternating current to a motor is performing drive control of a motor and accumulation-of-electricity control to a capacitor to coincidence.
[0003]
[Problem(s) to be Solved by the Invention] However, in such a power output unit, the torque which is not expected at the time of starting may be outputted from a motor. At the time of a halt of a system, it is common to discharge so that survival voltage may not act on a capacitor from viewpoints, such as endurance and safety, and it is common that a power source is also intercepted. If DC power supply are connected in order to put into operation the above-mentioned power output unit in the condition that DC power supply were intercepted after this capacitor had discharged, the circuit where DC power supply can charge a capacitor will be formed through the diode usually formed in each switching element of an inverter circuit, and the charging current will flow. Although motor torque will not be outputted if the synthetic impedance which consists of each phase of a motor and each phase of an inverter circuit is completely in agreement and the same current flows to each phase, the current from which a synthetic impedance differs in each phase in what is not completely in agreement flows, and the torque which is not expected from a motor arises.
[0004] Moreover, although it is common to prepare and consume the resistance for discharge to a capacitor and juxtaposition as for discharge of the capacitor made at the time of a halt of the above-mentioned system, since power is consumed as heat, the energy efficiency of the whole equipment will fall.
[0005] The power output unit of this invention sets to one of the purposes to prevent the output of the torque which is not expected to a motor at the time of starting. Moreover, the power output unit of this invention sets to start quickly to one of the purposes. Furthermore, the power output unit of this invention sets to raise the energy efficiency of equipment to one of the purposes. Or the power output unit of this invention sets to attain a miniaturization and simplification of equipment to one of the purposes.
[0006]
[The means for solving a technical problem, and its operation and effectiveness] The power output unit of this invention took the following means, in order to attain a part of above-mentioned purpose [at least].
[0007] The motor in which the 1st power output unit of this invention carries out a rotation drive by the power source and the polyphase current, Polyphase current power by switching actuation of two or more switching elements The inverter circuit which can be supplied to said motor, The connecting means which performs discharge of connection of said power source to the bus-bar of the either the positive-electrode bus-bar of said inverter circuit or the negative-electrode bus-bars and the neutral point of said motor, and

connection, The accumulation-of-electricity means which was connected to the positive-electrode bus-bar and negative-electrode bus-bar of said inverter circuit and in which charge and discharge are possible, and when starting directions are made, Let it be a summary to have the starting tense means which connects said power source by said connecting means after starting switching control to two or more switching elements of said inverter circuit at the time of starting.

[0008] In the 1st power output unit of this this invention, when starting directions are made, after a starting tense means starts switching control to two or more switching elements of an inverter circuit at the time of starting, the power source by the connecting means is connected. Therefore, since it is also switchable so that torque may not arise in a motor, while being able to prevent that unexpected torque is outputted from a motor, it can start quickly.

[0009] The motor in which the 2nd power output unit of this invention carries out a rotation drive by the power source and the polyphase current, Polyphase current power by switching actuation of two or more switching elements The inverter circuit which can be supplied to said motor, The connecting means which performs discharge of connection of said power source to the bus-bar of the either the positive-electrode bus-bar of said inverter circuit or the negative-electrode bus-bars and the neutral point of said motor, and connection, The accumulation-of-electricity means which was connected at the bus-bar to which said power source is not connected by said connecting means among the positive-electrode bus-bar of said inverter circuit, and a negative-electrode bus-bar, and the neutral point of said motor and in which charge and discharge are possible, and when starting directions are made, Let it be a summary to have connection of said power source by said connecting means, and a starting tense means to perform switching control at the time of starting to two or more switching elements of said inverter circuit.

[0010] In the 2nd power output unit of this this invention, when starting directions are made, switching control is performed at the time of starting to connection of the power source by the connecting means, and two or more switching elements of an inverter circuit. Therefore, since it is also switchable so that torque may not arise in a motor, while being able to prevent that unexpected torque is outputted from a motor, it can start quickly.

[0011] In the 1st of such this invention, or the 2nd power output unit, switching control shall be control which switches said two or more switching elements so that torque may not be outputted from said motor at the time of said starting.

[0012] Moreover, in the 1st of this invention, or the 2nd power output unit, switching control shall be control which switches said two or more switching elements so that the current which flows to each phase of said motor may become equal at the time of said starting. In the 1st of this invention of this mode, or the 2nd power output unit, it has each phase current detection means to detect the current of each phase of said motor. Said starting tense means Until this low ****** is canceled to the phase of the condition that a current value is low, among the currents of each phase detected by said each phase current detection means It shall be a means to perform control which switches said two or more switching elements so that said motor and said power source may form a short circuit as switching control at the time of said starting.

[0013] The motor in which the 3rd power output unit of this invention carries out a rotation drive by the power source and the polyphase current, Polyphase current power by switching actuation of two or more switching elements The inverter circuit which can be supplied to said motor, The connecting means which performs discharge of connection of said power source to the bus-bar of the either the positive-electrode bus-bar of said inverter circuit or the negative-electrode bus-bars and the neutral point of said motor, and connection, The accumulation-of-electricity means which was connected to the positive-electrode bus-bar and negative-electrode bus-bar of said inverter circuit and in which charge and discharge are possible, an accumulation-of-electricity condition detection means to detect the accumulation-of-electricity condition of this accumulation-of-electricity means, and when a stop order is made, Let it be a summary to have a halt tense means to perform discharge of connection of said power source by said connecting means, and predetermined switching control to two or more switching elements of said inverter circuit based on the accumulation-of-electricity condition of said accumulation-of-electricity means detected by said accumulation-of-electricity condition detection means.

[0014] In the 3rd power output unit of this this invention, when a stop order is made, a halt tense means performs discharge of connection of the power source by the connecting means, and predetermined switching control to two or more switching elements of an inverter circuit based on the accumulation-of-electricity condition of the accumulation-of-electricity means detected by the accumulation-of-electricity condition detection means. Therefore, according to the 3rd power output unit of this this invention, a halt based on the accumulation-of-electricity condition of an accumulation-of-electricity means can be

performed.
[0015] The motor in which the 4th power output unit of this invention carries out a rotation drive by the power source and the polyphase current, Polyphase current power by switching actuation of two or more switching elements The inverter circuit which can be supplied to said motor, The connecting means which performs discharge of connection of said power source to the bus-bar of the either the positive-electrode bus-bar of said inverter circuit or the negative-electrode bus-bars and the neutral point of said motor, and connection, The accumulation-of-electricity means which was connected at the bus-bar to which said power source is not connected by said connecting means among the positive-electrode bus-bar of said inverter circuit, and a negative-electrode bus-bar, and the neutral point of said motor and in which charge and discharge are possible, and when a stop order is made, Let it be a summary to have a halt tense means to perform discharge of connection of said power source by said connecting means, and predetermined switching control to two or more switching elements of said inverter circuit based on the accumulation-of-electricity condition of said accumulation-of-electricity means detected by said accumulation-of-electricity condition detection means.
[0016] In the 4th power output unit of this this invention, when a stop order is made, a halt tense means performs discharge of connection of the power source by the connecting means, and predetermined switching control to two or more switching elements of an inverter circuit based on the accumulation-of-electricity condition of the accumulation-of-electricity means detected by the accumulation-of-electricity condition detection means. Therefore, according to the 4th power output unit of this this invention, a halt based on the accumulation-of-electricity condition of an accumulation-of-electricity means can be performed.
[0017] In the 3rd of such this invention, or the 4th power output unit said halt tense means While holding connection of said power source by said connecting means in the condition that the accumulation-of-electricity condition of said accumulation-of-electricity means can act an electrical potential difference higher than the electrical potential difference of said power source The 1st switching control is performed at the time of a halt which switches said two or more switching elements so that the charge of said accumulation-of-electricity means may be supplied to said power-source side. While said connecting means cancels connection of said power source in the condition which cannot be acted in an electrical potential difference with the accumulation-of-electricity condition of said accumulation-of-electricity means higher than the electrical potential difference of said power source It shall be a means to perform the 2nd switching control at the time of a halt which switches said two or more switching elements so that the current from said accumulation-of-electricity means may flow to each phase of said motor. If it carries out like this, since some charges stored in the accumulation-of-electricity means can be returned to a power-source side, the energy efficiency of equipment can be raised. In the 3rd of this invention of this mode, or the 4th power output unit, switching control shall be control which switches said two or more switching elements so that torque may not be outputted from said motor at the time of switching control and said 2nd halt at the time of said 1st halt. If it carries out like this, it can prevent that the torque which is not expected from a motor is outputted.
[0018]
[Embodiment of the Invention] Next, the gestalt of operation of this invention is explained using an example. Drawing 1 is the block diagram showing the outline of the configuration of the power output unit 20 which is one example of this invention. The power output unit 20 of an example is equipped with DC power supply 32 connected through the relay 34 at the motor 22 which carries out a rotation drive by the three-phase alternating current, the capacitor 30 which changed direct current power into three-phase-alternating-current power, and was connected to the inverter circuit 24 which can be supplied to a motor 22, and the positive-electrode bus-bar 26 and the negative-electrode bus-bar 28 of an inverter circuit 24, and the negative-electrode bus-bar 28 of an inverter circuit 24 and the neutral point of a motor 22, and the electronic control unit 40 which controls the whole equipment so that it may illustrate.
[0019] The motor 22 is constituted as a synchronous generator motor which consists of stators around which Rota where the permanent magnet was stuck on the outside surface, and a three phase coil were wound and which can be generated. The revolving shaft of a motor 22 is the output shaft of the power output unit 20 of an example, and power is outputted from this revolving shaft. In addition, since it is constituted as a generator motor, the motor 22 of an example can be generated by the motor 22, if power is inputted into the revolving shaft of a motor 22. Moreover, DC power supply 32 are constituted as a rechargeable battery of for example, a nickel hydrogen system or a lithium ion system.
[0020] The inverter circuit 24 is constituted by six transistors T1-T6 and six diodes D1-D6. Six transistors

T1-T6 are arranged two pieces at a time in a pair so that it may become a source and sink side to the positive-electrode bus-bar 26 and the negative-electrode bus-bar 28, respectively, and each of the three phase coil (uvw) of a motor 22 is connected at the node. Therefore, if the rate of the ON time amount of transistors T1-T6 of making a pair is controlled by the condition that the electrical potential difference is acting on the positive-electrode bus-bar 26 and the negative-electrode bus-bar 28, rotating magnetic field can be formed with the three phase coil of a motor 22, and the rotation drive of the motor 22 can be carried out.

[0021] The electronic control unit 40 is constituted as a microprocessor centering on CPU42, and is equipped with ROM44 which memorized the processing program, RAM46 which memorizes data temporarily, and input/output port (not shown). In this electronic control unit 40 The neutral point current from the current sensor 58 attached at the current of each phase from current sensors 52-56 and the neutral point of a motor 22 which were attached in each phase of uvw of the three phase coil of a motor 22, the angle of rotation of the rotator of the motor 22 from the angle-of-rotation sensor 60 attached in the revolving shaft of a motor 22, The electrical potential difference Vc between terminals of the capacitor 30 from a voltage sensor 62 attached in the capacitor 30, the command value about actuation of a motor 22, etc. are inputted through input port. Moreover, from the electronic control unit 40, the control signal for performing switching control of the transistors T1-T6 of an inverter circuit 24, the driving signal to the actuator 35 of relay 34, etc. are outputted through the output port.

[0022] Next, actuation of the power output unit 20 of the example constituted in this way, especially the actuation at the time of starting are explained. Drawing 2 is a flow chart which shows an example of a manipulation routine at the time of starting performed with the electronic control unit 40 of the power output unit 20 of an example at the time of starting. This routine is performed when the trigger signal from the starting switch which is not illustrated is inputted into an electronic control unit 40.

[0023] If a manipulation routine is performed at the time of starting, CPU42 of an electronic control unit 40 will perform first processing which starts processing at the time of inverter starting (step S100). Processing is performed based on a manipulation routine at the time of inverter starting illustrated to drawing 3 at the time of this inverter starting. Since explanation is easy, processing is explained at the time of inverter starting. At the time of inverter starting, processing reads each phase currents Iu, Iv, and Iw first detected by current sensors 52-56 (step S110), and the minimum phase current is judged among each read phase currents Iu, Iv, and Iw (step S112). And the transistor of an inverter circuit 24 is switched so that it may become a short circuit about the phase corresponding to the minimum phase current (step S114), the transistor of an inverter circuit 24 is switched so that it may become a charge circuit about other phases (step S116), and this routine is ended. The circuit diagram of the power output unit 20 of the example which paid its attention to drawing 4 at the leakage inductance of the three phase coil (u phase) of a motor 22 is shown. The above-mentioned short circuit is a circuit shown by the drawing destructive line arrow head considering u phase formed in the condition of having set the transistor T2 of an inverter circuit 24 to ON, and a charge circuit is a circuit shown by the drawing solid line arrow head formed in the condition of having made off the transistor T2 of an inverter circuit 24. Since v phase of the three phase coil of a motor 22 and w phase are the same circuits as u phase, transistor T four and the condition of having turned on T6 are the short circuits of v phase and w phase, and transistor T four and the condition of having turned off T6 are the charge circuits of v phase and w phase.

[0024] Actuation of the circuit of drawing 4 which constitutes such a short circuit and a charge circuit is explained. In a short circuit, u phase of the three phase coil of a motor 22 functions as a reactor. If a transistor T2 is turned off from the condition of this short circuit and it is a charge circuit, the energy stored in u phase of the three phase coil which is functioning as a reactor will be stored in a capacitor 30. The electrical potential difference Vc of the capacitor 30 at this time can be made higher than the supply voltage of DC power supply 32. Therefore, it can be considered that this circuit is the pressure-up chopper circuit which carries out the pressure up of the energy of DC power supply 32 to a capacitor 30, and stores it in it. Here, the climbing speed of the current in a short circuit becomes settled with the electrical potential difference of DC power supply 32, and the inductance of the winding of a motor 22. On the other hand, although the climbing speed of the current in the charging current is the same as the climbing speed of the current of a short circuit the first stage, the climbing speed of a current becomes low as the electrical potential difference Vc between terminals of a capacitor 30 becomes high. Therefore, at the time of inverter starting illustrated to drawing 3 , a manipulation routine serves as processing which makes the climbing speed of the current of the phase of the minimum phase current larger than the climbing speed of the current of other phases by considering as a charge circuit to other phases while considering as a short circuit to the

phase corresponding to the minimum phase current. And by repeating and performing a manipulation routine at the time of this inverter starting, it goes up, while each phase current shows the almost same current value, and a capacitor 30 is charged.

[0025] If it returns to a manipulation routine at the time of starting of drawing 2 and processing is started at the time of inverter starting, DC power supply 32 will be connected by setting relay 34 to ON (step S102) at the negative-electrode bus-bar 28 and the neutral point of a motor 22. Before setting relay 34 to ON, since each phase currents Iu, Iv, and Iw are all values 0, even if which phase is made a short circuit by processing at the time of inverter starting and they are made into a charge circuit, they cannot charge a capacitor 30, but are in the same electric condition. If relay 34 is turned on and DC power supply 32 are connected, a value will arise in each phase currents Iu, Iv, and Iw, but although the value is few, a difference produces it from a difference of the climbing speed by the die length of the winding of each phase, the contact resistance of a node, etc. Based on a difference of each of these phase currents Iu, Iv, and Iw, at the time of inverter starting, a manipulation routine functions, and as mentioned above, each phase currents Iu, Iv, and Iw are similarly raised using a difference of the climbing speed of the current of a short circuit and a charge circuit. The situation of a rise of the phase current is illustrated to drawing 5 . Among drawing, a straight line A shows the change to the time amount of the phase current in a short circuit, real polygonal-line B shows the change to the time amount of the phase current by processing at the time of inverter starting, and a broken line C shows the change to the time amount of an average of the phase current. As shown in drawing solid polygonal-line B, the phase current repeats the charge of a capacitor 30 by the charge circuit, and the rise of the climbing speed by the short circuit, and goes up an average climbing speed (broken line C) with taking up and down a little.

[0026] If relay 34 is set to ON, the electrical potential difference Vc between terminals of the capacitor 30 detected by the voltage sensor 62 will be read (step S104), and processing which waits for the electrical potential difference Vc between this terminal to become beyond the threshold Vr will be performed (step S106). Here, a threshold Vr is the electrical potential difference of the capacitor 30 in the condition that the drive of a motor 22 can be started by the switching control of the transistors T1-T6 of an inverter circuit 24, and is set up as a value between the supply voltage and the electrical potential differences near 2 double of DC power supply 32. If the electrical potential difference Vc between terminals of a capacitor 30 becomes beyond the threshold Vr, processing will be suspended at the time of inverter starting (step S108), and processing will be ended at the time of starting.

[0027] According to the power output unit 20 of an example explained above, since DC power supply 32 are connected by setting relay 34 to ON after starting switching of the transistors T1-T6 of the inverter circuit 24 by inverter starting processing, each phase currents Iu, Iv, and Iw of a motor 22 are raised equally, and initial charge of a capacitor 30 can be performed. Since each phase currents Iu, Iv, and Iw are raised equally, a motor 22 is not made to produce torque. Consequently, it can prevent that the torque which is not expected on a motor 22 arises.

[0028] Next, the processing at the time of a halt of the power output unit 20 of an example is explained. Drawing 6 is a flow chart which shows an example of a manipulation routine at the time of a halt performed with the electronic control unit 40 of the power output unit 20 of an example at the time of a halt. This routine is performed when the stop signal from the safety switch which is not illustrated is inputted into an electronic control unit 40.

[0029] If a manipulation routine is performed at the time of a halt, first, CPU42 of an electronic control unit 40 will read the electrical potential difference Vc between terminals of the capacitor 30 detected by the voltage sensor 62 (step S200), and will perform processing in comparison with the electrical potential difference Vb to which the read electrical potential difference Vc between terminals can charge DC power supply 32 (step S202). When the electrical potential difference Vc between terminals of a capacitor 30 is larger than the electrical potential difference Vb which can be charged, charge processing is performed at the time of a halt which charges DC power supply 32 using the potential of a capacitor 30 (step S204), and it returns to step S200. At the time of a halt, charge processing is performed by repeating and performing a charge manipulation routine at the time of a halt illustrated to drawing 7 , after setting the transistor T2 by the side of the negative-electrode bus-bar 28, T four, and T6 to OFF, while setting the transistor T1 by the side of the positive-electrode bus-bar 26 of an inverter circuit 24, T3, and T5 to ON. If a charge manipulation routine is performed at the time of a halt, CPU42 of an electronic control unit 40 will read each phase currents Iu, Iv, and Iw detected by current sensors 52-56 (step S220), the phase current of the greatest current will be judged among each phase currents Iu, Iv, and Iw (step S222), and only predetermined time will make off the transistor by the side of the positive-electrode bus-bar 26 about the

phase of the greatest phase current (step S224). Here, predetermined time is time amount shorter than spacing by which a charge manipulation routine is repeated at the time of a halt. Each phase currents Iu, Iv, and Iw can be equalized by repeating this routine. Consequently, it can prevent that the torque which is not expected from a motor 22 is outputted at the time of charge.

[0030] If the electrical potential difference Vc between terminals of a capacitor 30 turns into below the electrical potential difference Vb that can be charged, DC power supply 32 will be intercepted, using relay 34 as off (step S206), and electrodischarge treatment will be performed at the time of a halt which consumes the charge which remains to a capacitor 30 by circuit resistance of an inverter circuit 24, or winding resistance of a motor 22. When consuming by circuit resistance of an inverter circuit 24, repeating turning on and off for transistors T1-T6, and controlling a current value, this processing forms a short circuit and consumes it as heat with transistors T1-T6. What is necessary is just to switch the transistors T1-T6 of an inverter circuit 24 as a zero torque command, in consuming by winding resistance of a motor 22. By considering as a zero torque command, each phase currents Iu, Iv, and Iw become equal, and it can prevent that the torque which is not expected from a motor 22 at the time of discharge is outputted.

[0031] According to the power output unit 20 of an example explained above, since some charges of a capacitor 30 are used at the time of a halt and DC power supply 32 are charged at it, the energy efficiency of equipment can be raised as compared with what consumes all the charges of a capacitor 30 by resistance. Moreover, since each phase currents Iu, Iv, and Iw are equalized in case some charges of a capacitor 30 are consumed by circuit resistance of an inverter circuit 24, or winding resistance of a motor 22, it can prevent that the torque which is not expected from a motor 22 is outputted.

[0032] Although DC power supply 32 were attached in the power output unit 20 of an example so that the negative-electrode bus-bar 28 of an inverter circuit 24 and the neutral point of a motor 22 might be connected through relay 34, it is good also as what attaches DC power supply 32 for the positive-electrode bus-bar 26 of an inverter circuit 24, and the neutral point of a motor 22 through relay 34.

[0033] Moreover, in the power output unit 20 of an example, the capacitor 30 was attached so that the positive-electrode bus-bar 26 and the negative-electrode bus-bar 28 of an inverter circuit 24 might be connected, but as shown in power output unit 20B of the modification of drawing 8 , it is good also as what attaches capacitor 30B so that the positive-electrode bus-bar 26 of an inverter circuit 24 and the neutral point of a motor 22 may be connected. Drawing 9 is the circuit diagram of power output unit 20B of a modification which paid its attention to the leakage inductance of the three phase coil (u phase) of a motor 22. In power output unit 20B of a modification, considering u phase, a short circuit is a circuit shown by the drawing destructive line arrow head formed in the condition of having set the transistor T2 of an inverter circuit 24 to ON, and a charge circuit is a circuit shown by the drawing solid line arrow head formed in the condition of having made off the transistor T2 of an inverter circuit 24. Since v phase of the three phase coil of a motor 22 and w phase are the same circuits as u phase, transistor T four and the condition of having turned on T6 are the short circuits of v phase and w phase, and transistor T four and the condition of having turned off T6 are the charge circuits of v phase and w phase. If each of transistors T2, T four, and T6 is off when relay 34 is turned on and DC power supply 32 are connected in power output unit 20B of this modification, the charging current will not flow. Although charge of capacitor 30B is not immediately started like the power output unit 20 of an example, in order not to make a motor 22 generate torque at the time of the need of charging capacitor 30B the first stage, and its charge, processing is needed at the time of the same starting as the power output unit 20 of an example. Specifically except for the point set up between the values near the electrical potential difference of DC power supply 32 from a value 0 in a threshold Vr, a manipulation routine can be used as it is at the time of inverter starting of a manipulation routine and drawing 3 at the time of starting of drawing 2 . Therefore, power output unit 20B of a modification can also do so the effectiveness at the time of starting in the power output unit 20 of an example, i.e., the effectiveness that it can prevent that the torque which is not expected on a motor 22 at the time of charge of capacitor 30B arises. In the power output unit 20 of a modification, at the time of a halt, the short circuit in capacitor 30B can be formed by setting a transistor T1 to ON, a three phase coil can be operated as a reactor, and DC power supply 32 can be charged using reactor energy by making a transistor T1 off. Under the present circumstances, if the min or max of each phase currents Iu, Iv, and Iw is judged and a transistor T1, T3, and T5 are turned on and off, since each phase currents Iu, Iv, and Iw can be equalized, power output unit 20B of a modification can also use a charge manipulation routine as it is at the time of a halt of a manipulation routine or drawing 7 at the time of a halt of drawing 6 . Therefore, power output unit 20B of a modification can also do so the effectiveness at the time of a halt in the power output unit 20 of an example, i.e., the effectiveness that it can prevent that the torque as which it is expected neither on the effectiveness of

raising the energy efficiency of equipment, nor a motor 22 arises.
[0034] In power output unit 20B of a modification Although DC power supply 32 were attached so that the negative-electrode bus-bar 28 of an inverter circuit 24 and the neutral point of a motor 22 might be connected through relay 34 while attaching capacitor 30B so that the positive-electrode bus-bar 26 of an inverter circuit 24 and the neutral point of a motor 22 might be connected While attaching DC power supply 32 for the positive-electrode bus-bar 26 of an inverter circuit 24, and the neutral point of a motor 22 through relay 34, it is good also as what attaches capacitor 30B so that the negative-electrode bus-bar 28 of an inverter circuit 24 and the neutral point of a motor 22 may be connected.
[0035] Although each phase currents Iu, Iv, and Iw shall be equally raised in the power output unit 20 of an example, or its modification by repeating and performing processing which sets other phases as a charge circuit while setting the phase of the minimum phase current as a short circuit While setting the phase of the greatest phase current as a charge circuit, it does not matter as what raises each phase currents Iu, Iv, and Iw equally by repeating the processing which sets other phases as a short circuit. Although charge of Capacitors 30 and 30B takes time amount as compared with the power output unit 20 of an example, it is because the phase current of a motor 22 can be raised equally.
[0036] Although the synchronous generator motor driven by the three-phase alternating current as a motor 22 was used in the power output unit 20 of an example, or its modification, it is good also as a thing using what kind of type driven by the polyphase current of motor.
[0037] As mentioned above, although the gestalt of operation of this invention was explained using the example, as for this invention, it is needless to say that it can carry out with the gestalt which becomes various within limits which are not limited to such an example at all and do not deviate from the summary of this invention.

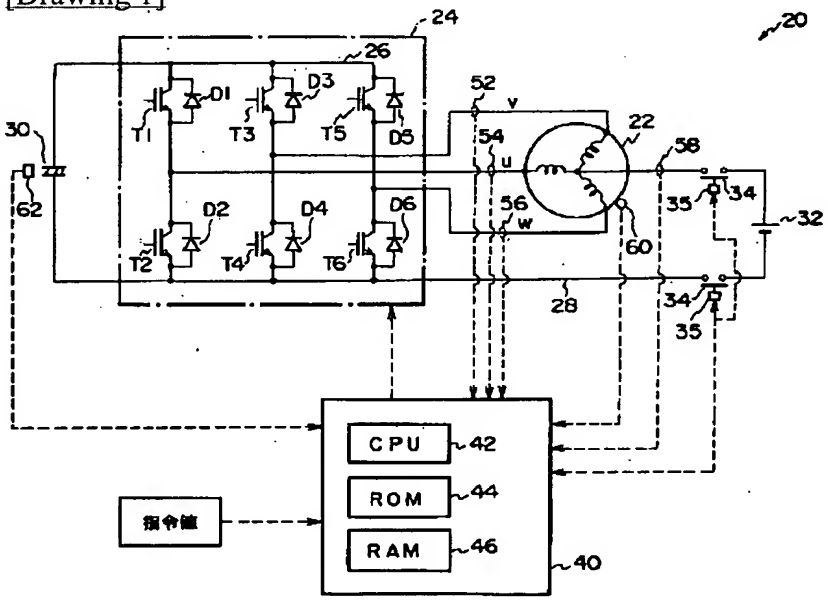
[Translation done.]

* NOTICES *

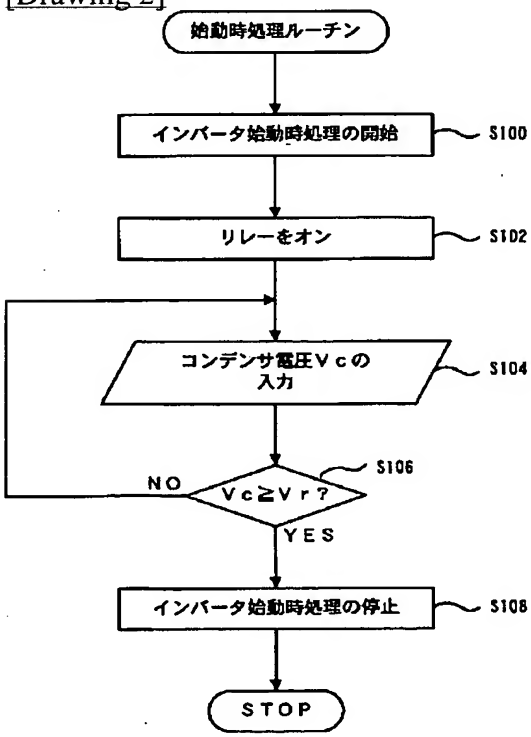
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

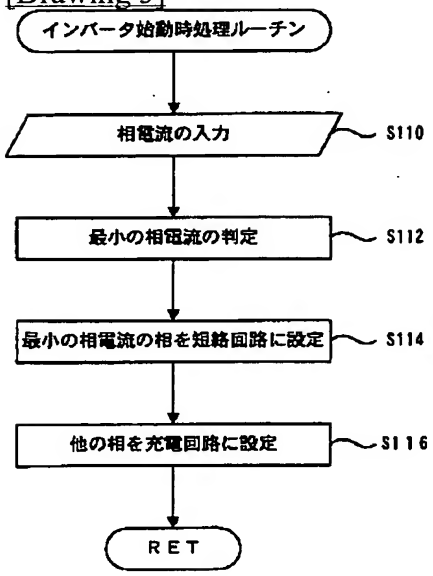
[Drawing 1]



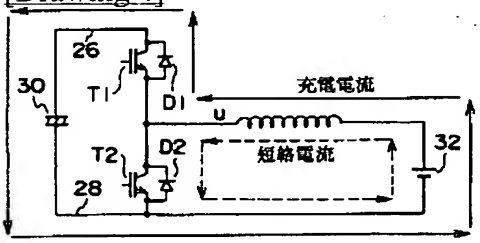
[Drawing 2]



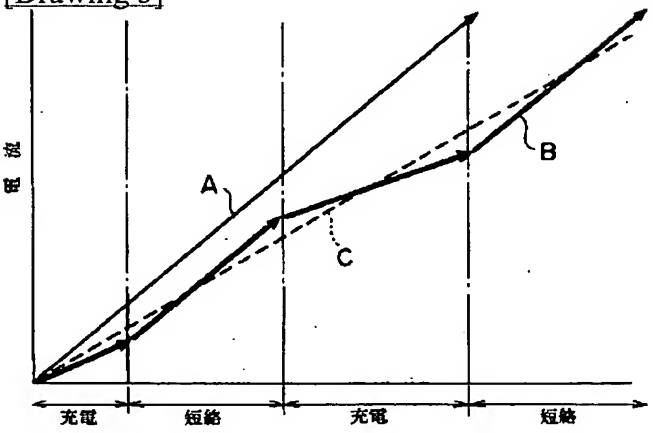
[Drawing 3]



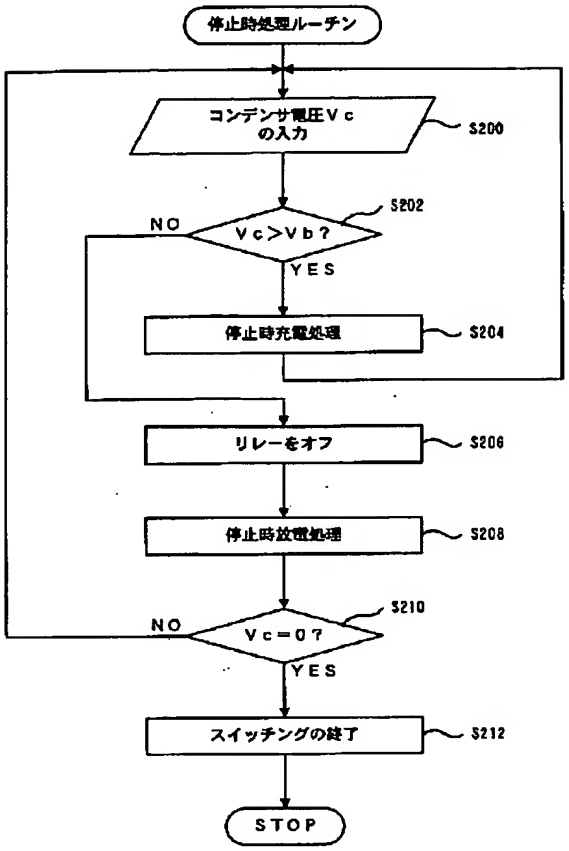
[Drawing 4]



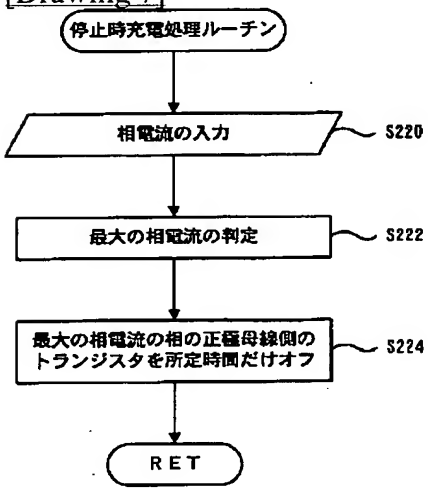
[Drawing 5]



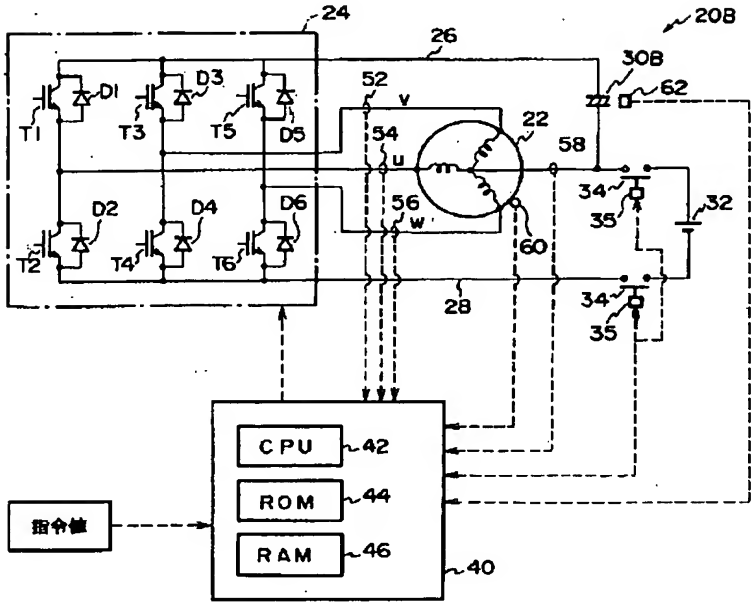
[Drawing 6]



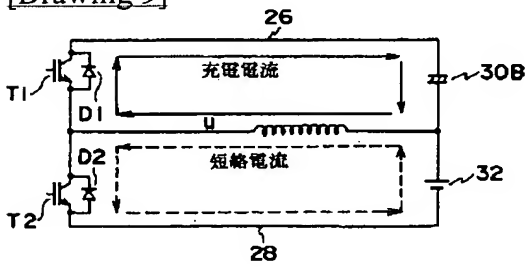
[Drawing 7]



[Drawing 8]



[Drawing 9]



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